

Parkersburg, W. Va., 28th, running ice in Ohio and Kanawha rivers; 29th, ice in Kanawha River; 30th, considerable running ice in Ohio River.

Pittsburg, Pa., navigation closed on the Monongahela River 29th, and on the Ohio River 30th.

Port Huron, Mich., 14th, last up-boat of the season passed up the lake to-day; the last boat going down the lake 19th; 28th to 31st, floating ice on lake and in St. Clair River.

Rochester, N. Y., Erie Canal closed to navigation 1st.

Sandusky, Ohio, navigation closed 16th.

Sault Ste. Marie, Mich., navigation closed 6th.

Sioux City, Iowa, navigation closed 28th.

Toledo, Ohio, navigation closed 27th.

Bluffton, Mo., 28th, floating ice in Missouri River.

Miami, Mo., 28th, Missouri River blocked by ice.

Lynch, Nebr., 25th, navigation on Missouri River closed.

Niobrara, Nebr., 29th, teams crossing the ice on Missouri River.

Pierre, S. Dak., Missouri River frozen during the month.

Muscatine, Iowa, 28th, heavy floating ice in Mississippi River.

Marietta, Ohio, floating ice in Ohio River 29th to 31st.

Paducah, Ky., 29th to 31st, running ice in Ohio River.

North McGregor, Iowa, 15th, ice moved out of Mississippi River; 26th, river closed at 4.30 a. m.

St. Joseph, Mo., ice in Missouri River, 2d; river clear of ice at 3 p. m., 6th; 27th, running ice.

Portsmouth, Ohio, floating ice in Ohio River 29th to 31st.

Wheeling, W. Va., 27th to 31st, floating ice in Ohio River.

Kansas City, Mo., 28th, floating ice in Missouri River; 29th, river frozen.

Dubuque, Iowa, 29th, Mississippi River frozen.

Davenport, Iowa, 1st to 6th, ice in Mississippi River; 29th, river frozen.

Cincinnati, Ohio, 29th, Ohio River partly frozen.

Chester, Ill., 28th, ice in Mississippi River.

Le Claire, Iowa, Mississippi River frozen 1st to 6th; river clear 7th; river frozen 27th.

Hermann, Mo., 12th, navigation closed on Missouri River; 28th, heavy floating ice; 30th, river gorged at 11 a. m.

Freeport, Pa., 29th, floating ice in Allegheny River; 30th, river closed.

Greensboro, Pa., 29th, navigation closed on Monongahela River.

Lock No. 4, Pa., Monongahela River frozen 28th; 29th to 31st, running ice.

## SUNSHINE AND CLOUDINESS.

### GENERAL REMARKS.

The quantity of sunshine, and therefore of heat, received by the atmosphere is a fundamental factor in meteorology; the quantity received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends largely upon the absorption by the atmosphere and varies with the distribution of cloudiness. The sunshine is now recorded automatically at about 38 regular stations of the Weather Bureau, either by its photographic or its thermal effects. The cloudiness is recorded by personal observations at all stations and is given in the column of "average cloudiness" in Table I.

### SUNSHINE.

An instrumental record of sunshine has been kept during the month at 16 stations by means of the photographic sunshine recorder and at 24 stations by means of the thermometric sunshine recorder; the results of these observations are given in Table IV, for each hour of local mean time (not seventy-fifth meridian time). The stations recording the largest percentages of sunshine between the hours of 11 a. m. and 1 p. m. were: Key West, 92; Denver, 85.5; Norfolk, 82.5; New Orleans, 78; Vicksburg, 77.5. The stations having the least percentage between those hours were: Cleveland, 27; Portland, Oreg., 31; Rochester, 33.5; Spokane, 35; Tucson, 39.5.

The general average percentage for the whole month is given in the next to the last column of Table IV. The highest percentages were: Key West, 79; Denver, 73; Norfolk and Dodge City, 71; Savannah, 70; Baltimore, 66; New Orleans, 65; Galveston and New Haven, 63. The lowest percentages were: Cleveland, 25; Rochester, 28; Portland, Oreg., 30; Spokane, 33; Seattle and Columbus, Ohio, 37; Tucson, 39.

### CLEAR SKY.

The average cloudiness between sunrise and sunset, as based on numerous personal observations, is given for each Weather Bureau station in Table I; the complement of this average cloudiness gives the observer's estimated percentage of clear

sky and these latter numbers are given in the last column of Table IV.

### COMPARISON OF SUNSHINE AND CLEAR SKY.

The sunshine registers give the duration of direct sunshine whence the percentage of possible sunshine is derived; the observer's personal estimates give the percentage of area of clear sky. It should not be assumed that these numbers should agree, and for comparative purposes they have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental record of percentages of duration of sunshine is almost always larger than the observer's personal estimates of percentages of area of clear sky; the average excess for this month is 3 per cent for photographic records and 6 per cent for thermometric records. Attention has lately been called to a similar excess in the records of the observers in India.

### Difference between instrumental and personal observations of sunshine.

Photographic stations.	Instrumental.	Personal.	Difference.	Thermometric stations.	Instrumental.	Personal.	Difference.
Denver, Colo. ....	73	65	8	Key West, Fla. ....	79	67	12
Dodge City, Kans. ....	71	63	8	Norfolk, Va. ....	71	55	16
Savannah, Ga. ....	70	63	7	Baltimore, Md. ....	66	55	11
Galveston, Tex. ....	63	62	1	New Orleans, La. ....	65	55	10
Santa Fe, N. Mex. ....	60	51	9	New Haven, Conn. ....	63	55	8
Kansas City, Mo. ....	59	57	2	Wilmington, N. C. ....	63	55	8
Bismarck, N. Dak. ....	58	55	3	St. Louis, Mo. ....	58	51	7
Memphis, Tenn. ....	55	50	5	Vicksburg, Miss. ....	56	51	5
Helena, Mont. ....	54	49	5	Philadelphia, Pa. ....	55	49	6
Eastport, Me. ....	50	35	15	Washington, D. C. ....	55	51	4
Cincinnati, Ohio. ....	45	40	5	Des Moines, Iowa. ....	55	51	4
San Diego, Cal. ....	42	42	0	Boston, Mass. ....	55	45	10
Tucson, Ariz. ....	39	32	7	Salt Lake City, Utah. ....	52	38	14
Spokane, Wash. ....	33	26	7	Little Rock, Ark. ....	51	40	11
Portland, Oreg. ....	30	43	-13	San Francisco, Cal. ....	48	26	22
Cleveland, Ohio. ....	25	31	-6	Chicago, Ill. ....	45	44	1
				Louisville, Ky. ....	45	35	10
				New York, N. Y. ....	45	43	2
				Portland, Oreg. ....	43	43	0
				Buffalo, N. Y. ....	39	29	10
				Detroit, Mich. ....	38	34	4
				Columbus, Ohio. ....	37	37	0
				Seattle, Wash. ....	37	38	-1
				Rochester, N. Y. ....	28	28	0

No record for Portland, Me. \* Formerly a photographic now a thermometric register. Record for 29 days.

## OBSERVATIONS ON THE GREAT LAKES.

### REPORTS FROM U. S. LIFE-SAVING STATIONS.

Through the co-operation of the General Superintendent of the Life-Saving Service and the Secretary of the Treasury, the Weather Bureau has received monthly reports for the

month of December, from the keepers of 24 U. S. Life-Saving Stations on the Great Lakes.

### REPORTS FROM VESSELS.

The Lake Marine Section, Forecast Division, has received reports from the captains of 60 vessels navigating the Great Lakes.